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UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 950

Contribution from the Forest Service
WILLIAM B. GREELEY, Forester

Washington, D. C.

PROFESSIONAL PAPER

June 15, 1921

REGIONAL DEVELOPMENT OF
PULPWOOD RESOURCES
OF THE
TONGASS NATIONAL FOREST
ALASKA

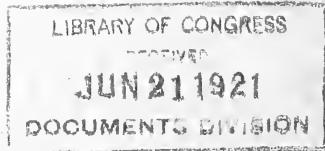
By
CLINTON G. SMITH, Forest Inspector



Alaska—Tongass and Chugach National Forests.

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By CLINTON G. SMITH, *Forest Inspector.*

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OBJECTS OF THIS STATEMENT.

This statement has been prepared to aid those who wish information on the timber and other resources of the Tongass National Forest in Alaska, to indicate the capital and organization necessary for the development of Alaskan pulp and paper mills, to show what data on the timber resources of that region have been and are being collected by the Forest Service, and to outline the conditions of purchase of timber on the National Forests.¹

¹ Acknowledgment is made to the Forest Products Laboratory for technical features; particularly to a report by H. E. Surface, entitled "Conditions Existing for the Manufacture of Pulp and Paper in Alaska," material from which has been freely used; and also to the district forester at Portland, Oreg., for valuable assistance.

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DEMAND FOR PULP AND PAPER.

The time seems to be ripe for the extensive exploitation of Alaskan pulpwood. The successful operation of pulp and paper mills in near-by British Columbia, which has practically similar timber and power resources and comparable transportation facilities, removes the speculative element from the proposed development. The demand for paper has increased to such an extent that it has become possible for well-organized and adequately financed companies to operate pulp and paper mills on an extensive scale, particularly for making newsprint. Ten years ago the United States produced its entire supply of newsprint. In 1919 two-thirds of it was imported, mostly from Canada; and Canadian supplies are not without limit.² All indications point to a continuance of the demand at prices which should make possible profitable operations in Alaska.

New sources are imperatively required for the supply of raw pulpwood. This need has already brought mills to the Pacific coast. They were located, first in California, Washington, and Oregon, and then in British Columbia. The same transition has taken place in the lumber industry, and the production of lumber in the Pacific Northwest is increasing steadily. The movement in the pulp industry, however, is necessarily slower, because of the greater investment called for per unit and the very large requirement for power. Furthermore, the pulp industry demands an assured permanent supply of raw material and a proper allocation of water power under stable tenure, both of which requisites are found in the Tongass National Forest in southeastern Alaska. It is the policy of the Forest Service to sell pulpwood from the National Forests with such provisions for future supply as will assure the permanence of the industry.

ADVANTAGES OF REGIONAL DEVELOPMENT.

There is room for a number of mills on the Tongass Forest. When these are in operation, together with the established mills of British Columbia, which are reported³ to represent an investment of \$42,000,000, they will constitute a producing region whose products will have a recognized standing in the world's markets. The development of this region will facilitate the procurement of sales contracts and needed capital, make it possible to attract both skilled and unskilled labor, and, lastly, but by no means of least importance, enable the industry to secure favorable conditions and rates for the transportation of its products. These are prime factors in the success of an operation of any magnitude, and are recognized as such.

² See "Some Startling Facts About Canada's Forests," by Frank D. Barnjum, in the Pulp and Paper Magazine of Canada, Jan. 1, 1920, reprints of which are available from the publishers.

³ See consular letter of J. J. Johnson, Feb. 20, 1920.

Well-known examples of regional localization of industry are steel production at Pittsburgh and Gary, the making of automobiles at Detroit, textile and other manufacturing in New England, and so on. The possibilities of regional development can scarcely be overemphasized.

Pioneer conditions of the region have been met and overcome by the successful establishment of mills in near-by British Columbia. After much expenditure of time and money, and in spite of some reverses, a number of going concerns are manufacturing pulp and paper in British Columbia along the coast between Seattle and Prince Rupert.

Some of the earlier projects on the Pacific coast were started before the time was ripe for their success. The prices for products were too low to offset the costs involved in establishing a new industry far removed from consuming centers and with consequent high transportation charges. The paper shortage has radically changed the situation. Market requirements necessitate an expansion of the industry and seem to preclude a return to the old-time price levels.

IMPORTANCE OF ALASKA AS A SOURCE OF PAPER SUPPLY.

Secretary of Agriculture Meredith recently said:

Alaska is destined to become a second Norway. With her enormous forests of rapidly growing species suitable for pulp, her water power, and her tide-water shipment of manufactured products, Alaska will undoubtedly become one of the principal paper sources of the United States. A substantial development of the paper industry in this wonderful region, combined with the intelligent reforestation of pulp lands in the older regions, should settle forever the question of a paper shortage in the United States.

Within the last 10 years, he points out, "the Forest Service has brought about the sale of 420,000,000 feet of saw timber in the National Forests of Alaska."

The Department of Agriculture believes that the development of the forest and water-power resources of Alaska is a practicable means of increasing the supplies of newsprint available for the United States, and therefore of eventually lessening the paper shortage now so acute. The National Forests of Alaska probably contain 100,000,000 cords of timber suitable for the manufacture of newsprint and other grades of paper. Under careful management these Forests can produce 2,000,000 cords of pulpwood annually for all time, or enough to manufacture one-third of the pulp products now consumed in the United States.

The Alaskan forests also contain the second chief essential of the paper-manufacturing industry—water power. While no accurate survey of water power has been made, known projects have a pos-

sible development of over 100,000 horsepower; and the Forest Service estimates that a complete exploration of the National Forests in southern Alaska will disclose their potential horsepower to be not less than a quarter of a million.

Scarcely any other part of the country offers a field for the upbuilding of a permanent pulp and paper industry equal to that afforded by Alaska. It is a virgin field because, in spite of its natural advantages and vast supplies of raw material, economic conditions had not, prior to 1919, become sufficiently favorable to attract capital. For years the Forest Service tried in vain to interest capital in the development of enterprises for paper production in Alaska. Had it succeeded these enterprises would now be in a very advantageous position.

It may be said in passing that the purpose of the Forest Service looks beyond merely finding a market for Government timber in order that the timber may be cut and a new growth started in its place. The Forests are administered as public properties created to serve public needs. Alaska's first need is capital. It has not yet reached a point at which the upbuilding of the Territory can be effected merely by an influx of pioneers of the type that conquered the wilderness in our Western States. While development must be a gradual process governed by economic facts, large-scale operations are essential. To the extent that conditions can be made favorable for such operations development will be hastened.

Public ownership of the National Forests and their administration in accordance with the general policy pursued by the Forest Service affords capital certain important advantages. The amount of the investment necessary is greatly reduced by the fact that the Service is in position to guarantee permanent supplies, on reasonable terms as to price, and made available as needed. In other words, the operator does not need to invest heavily in raw material or assume the speculative risks involved when timber must be carried for a number of years with accumulating charges before manufacture. Again, prospective operators do not have to negotiate with a number of different owners or spend time and money in building up an operating unit. It is the desire of the Government to facilitate the establishment of mills, and the Forest Service is therefore glad to make available all the information that it can secure and to offer terms and conditions of sale that will interpose no unnecessary or unreasonable obstacles to development.

The value to Alaska of a pulp and paper industry on the National Forests can scarcely be overstated. By creating a demand for labor it will build up the population; by creating a market for farmers' crops it will stimulate agricultural development; and it will improve transportation facilities and benefit all kinds of business. The Ter-

ritory has been losing population and retrograding commercially and industrially in the last few years, primarily because after the first cream of her mineral wealth had been skimmed general economic conditions were not favorable to immediate further progress. An alteration in these conditions now opens an opportunity to start the tide running the other way.

Obviously, the building up of Alaska generally will work to the advantage of any business enterprise located there, since it will make for better living conditions, greater contentment and stability of labor, and superior facilities of many kinds. At the same time that the interests of Alaska will be advanced by establishment of a local paper and pulp industry, such an industry will itself participate in the benefits of local development.

LOCATION OF THE REGION.

The timber described in this report is situated along the coast and on the large islands of southeastern Alaska, on the Tongass National Forest. The region is about as far west as it is north of Seattle and takes the one hundred and fiftieth meridian time, which is one hour slower than Pacific coast time. The largest towns in southern Alaska are Juneau and Ketchikan. Ketchikan, which lies at the extreme southern end, is only 670 miles from Seattle and approximately only one-third of the distance from Seattle to the well-known town of Dawson on the Yukon River, in the Klondike region. Ketchikan is only 60 hours by steamer from Seattle and is only 93 miles from Prince Rupert, British Columbia, the terminus of the Grand Trunk Pacific, a transcontinental railroad. The scheduled time for passenger trains from eastern points is seven days. It is possible to ship freight by car ferry from Ketchikan to Prince Rupert, and thence by rail eastward to its destination.

COMMUNICATION AND ACCESSIBILITY.

Southeastern Alaska is favored with numerous deep-water harbors open the year round, and there is comparatively smooth water in the straits and passages. This region is advantageously located, with reference to shipments by rail and water, to the United States and water shipments to the Orient, South America, and Australasia.

The distances by water and rail to important markets are:

From—	To—	Distance.
Prince Rupert.....	(Chicago..... New York..... Seattle.....)	Statute miles. 2,653 3,566 932
Sitka.....	(Chicago..... New York..... Boston.....)	3,113 4,021 4,134

From—	To—	Distance.
Sitka.....	San Francisco.....	Nautical miles. ¹ 1,302
	New York.....	6,564
	Honolulu.....	2,386
	Sidney.....	6,806
	Wellington.....	6,499
	New York (via Panama).....	5,262
San Francisco.....	New York (via Magellan Strait).....	13,135
	Yokohama.....	4,536
	Shanghai.....	5,387
	Manila.....	6,221
	Honolulu.....	2,091
	Panama.....	3,245
	Valparaiso.....	5,135

¹ A nautical mile equals 1.15 statute miles.

Regular mail service by boat to and from Alaska is maintained throughout the year. The region is served by a military cable to Seattle, available to the public. Wireless stations, both Government and private, are well distributed along the coast.

During the last two weeks in April, 1920, the West Coast Lumberman reported that about 100 cargoes for Alaska were loaded at Portland. Most of these cargoes were destined for the canneries. Several steamship lines ply regularly from Alaska to the "outside." The Pacific Coast Steamship Co. operates four steamships. The Alaska Steamship Co. operates five passenger steamships and nine freight steamers. The Grand Trunk Pacific operates in the Alaskan service two steamers and the Canadian Pacific one.⁴ The Union Steamship Co. operates 10 steamers to Alaskan ports. There are a number of other boats operating to Alaska, and at Ketchikan the number of clearances of vessels per year is in the neighborhood of 2,000.

From the regular ports of call reached by coastwise steamers, fishing boats, and mail boats, the outlying regions are reached only by special trips with gasoline boats. The type of boat used most successfully by the Forest Service is 45 feet long, and should have a crew of two men; but the Service does not have the facilities to take interested parties on investigating trips for timber and power-site locations. There are, however, a limited number of boats for hire at all the principal ports at rates depending on the demand for the service and the character of the trip.

TOPOGRAPHIC AND OTHER SURFACE FEATURES.

Burchard (U. S. Geological Survey Bulletin 592, 1914, p. 97), describes the general topographic and surface features as follows:

The mainland and islands of southeastern Alaska are generally mountainous, and there is little level land either as upland area or along the shores. Along

⁴ The Merchant Marine Act of June 15, 1920, makes certain restrictions upon the transportation of merchandise, and any one interested in Alaska would do well to familiarize himself with the provisions of this act.

much of the coast line the hills and mountains rise abruptly⁵ and the dense forest growth, extending down to the level of high tide, overhangs the steep banks. The islands are separated by an intricate system of waterways and fiords, known locally as straits, canals, channels, passages, sounds, narrows, inlets, bays, coves, and arms, some of which reach far inland. Many of these waterways are very deep and can be safely navigated by the largest ocean steamers, but some are so shallow as to be navigable only at high tide by boats of moderate draft. The coast and entrances to harbors are rocky and in places the greatest care is necessary in order to avoid rocks that are barely submerged. The topography is so rough that only in favored localities or at great expense can wagon or tram roads be constructed. The waterways are, therefore, of great value in affording routes of communication between different portions of the region and between this region and the Pacific coast ports of the United States. Indeed, were it not for water transportation the mining and quarrying industries in southeastern Alaska could scarcely have been developed.

The rock surface is in general thickly overgrown with small to medium-sized timber and dense underbrush and has a soil cover of decayed wood, moss, and mold, from a few inches to 3 or 4 feet thick as a rule, but thicker in hollows and crevices in the rock.

CLIMATE OF THE REGION.

Accurate climatic data for the region, based on observations taken at all the larger towns, are available from the records of the Weather Bureau. It must be remembered that these data were taken near tidewater, and that the annual precipitation of a given catchment basin which includes country in the higher altitudes can not be assumed to be the same as at sea level. In this respect the data will be found lacking.

The dense forests bordering the shore line of southeastern Alaska are the result of the moist, humid climate. The records show that the annual rainfall ranges between 80 and 130 inches. Three-quarters of the precipitation occurs from March to November. In the high altitudes the winter precipitation is largely in the form of snow, and in consequence the winter run-off is much less than that of the rainy season.

There is a difference of only 2° in mean annual temperature between Puget Sound and Sitka. The mean temperature for January is 33° and for August 56°, an annual range of only 23° at Sitka. At Juneau, on the mainland, there is less oceanic influence, and the mean annual temperature is lower, the difference being more marked in winter than in summer. The harbors of southeastern Alaska are ice-free the year round, and the water is warm enough to favor the marine teredo, which is very active in salt water in southeastern Alaska, so much so that piles designed to be permanent must be coated with protective covering of cement or otherwise protected.

⁵ Reaching a maximum elevation varying from 4,000 feet in the southern part to 7,000 feet in the northern.

Altitude has a profound effect on climate, and this is shown in tree growth. The limit of merchantable timber is found at about 2,500 feet above sea level.

Work in the open is possible at all times of the year, but logging operations are not profitable in the short days of winter. It is likely that a mill would rely on stored pulpwood for a three or four months' run. In Ketchikan it is said to be necessary to use artificial lights after 3 o'clock in the afternoon in December. It is stated that the low summer temperature would be of advantage in sulphite-mill practice.

TIMBER AND STAND.

The most widely distributed commercial tree on the Tongass Forest is western hemlock (*Tsuga heterophylla*). It is a rapidly growing tree, and is suitable for either mechanical or chemical pulp, either alone or in mixture with other species. It is conservatively estimated that it forms 60 per cent of the merchantable stand. It is being extensively used for pulp at a number of plants in British Columbia.

Sitka spruce (*Picea sitchensis*) forms about 20 per cent of the stand. It varies greatly in percentage of mixture, from pure stands of 10 acres or less to stands in which it is found only here and there. Spruce and hemlock form increasingly larger percentages of the stand of timber toward the north.

Other species forming approximately 20 per cent of the stand are western red cedar (*Thuja plicata*) and yellow cypress (*Chamæcypris nootkatensis*) with a little cottonwood, birch, lodgepole pine, and white fir.

The stand of timber on the Tongass Forest is roughly estimated at 9,000 feet, board measure, per acre, and the timber forms a belt back from the coast that averages approximately 1 mile in width and varies from a minimum width of one-fourth mile or less to a maximum of 5 miles. An average stand of 20,000 feet per acre of merchantable timber was found in a cruise of the Behm Canal Unit, and individual stands of 100,000 feet per acre have been found over small areas. The Behm Canal Unit, as shown on the map, has a stand of approximately 1,000,000,000 feet, board measure, of which 88 per cent is spruce and hemlock. Spruce is used locally for lumber, box shooks, and piling; cedar for lumber and shingles; and hemlock for lumber and piling.

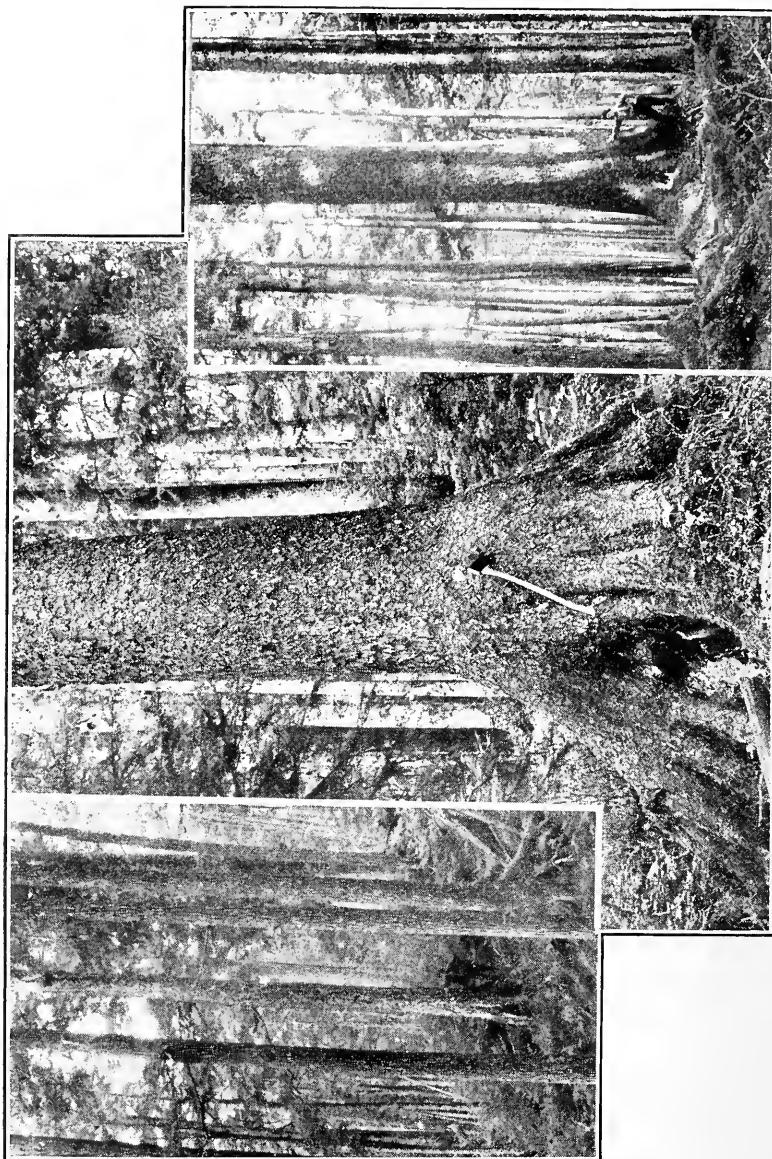
Practically all of the timber in southeastern Alaska is under the control of the Government and is within the boundaries of the National Forest, the exceptions being reservations and town sites. The area of land in private ownership is small.



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STAND OF HEMLOCK AND SPRUCE ON REVILLAGIGEDO ISLAND, TONGASS NATIONAL FOREST, ALASKA.

Western hemlock constitutes about 60 per cent and Sitka spruce about 20 per cent of the merchantable timber in southeastern Alaska.



STANDS OF SITKA SPRUCE AND WESTERN HEMLOCK, WITH "CLOSE-UP" SPRUCE IN CENTER, ON ALASKA NATIONAL FORESTS.

QUALITY OF TIMBER.

The spruce in the commercial sizes is generally sound and of good quality. The hemlock, however, is apt to be defective, the damage consisting of partial decay at the butt, "black knots," or fluted trunks. The latter defect is pronounced only in the butt logs of the smaller trees, the bark in the very worst cases being recessed almost to the center in three or four places around the circumference. The smaller and inferior trees of both species are apt to have numerous limbs extending near the ground. In general, hemlock is not the equal of the spruce for pulp making and for lumber, as well as for many other purposes, and its present stumpage price is therefore commonly about half that of spruce.

All estimates in this report are based on stands from which wood "merchantable for pulp" may be taken. For either hemlock or spruce, decay in butt logs of "merchantable pulpwood" seldom exceeds 15 to 20 per cent, and the decayed portion may be eliminated when the wood is prepared for pulp making; that is, when it is being split or "broken up" with saws. Even when timber is badly affected with "black knots," the knots may be completely removed at an additional cost for "preparing," over the ordinary cost, of about \$1 per thousand for handwork; that is, chopping with an ax, as evidenced in actual practice. By using proper mechanical means this extra cost of preparing the wood can be reduced one-third to one-half.

Fluted trunks may be used, since in preparing the wood for the "barkers," pulpwood bolts over 12 inches in diameter must be "sized" or split anyhow. Therefore, in splitting, the pieces may as well be separated on the "flutings" as elsewhere. The standardrossing machines then can easily remove all of the bark without excessive waste of good wood. That "limbiness" is not a serious objection is evidenced by the fact that many eastern mills now use wood from the tops of trees to as small a top diameter as 3 inches.

Cottonwood may be included in some of the Alaskan sales as a pulpwood, and it is locally considered to be suitable for no other use. The Alaskan cottonwood is of about the same character as cottonwood grown elsewhere.

All spruce and hemlock now considered merchantable for saw timber would make a high grade of pulpwood so far as defects are concerned. The proportions of timber merchantable for saw timber and of that merchantable for pulpwood but not for saw timber would, of course, vary in different stands, and this feature would be carefully studied in developing specific projects.

SUITABILITY FOR PULP AND PAPER.

So far as suitability of species for pulp making is concerned, it should be sufficient to point to the British Columbia and Pacific Northwest pulp mills now operating on Sitka spruce and western hemlock. At times the hemlock alone is used, and it is said to prove as satisfactory as in mixture with quick-cook sulphite fiber, as far as quality of product is concerned. In addition to newsprint, only a few grades of building and mill wrapping paper are made at the British Columbia plants; but hemlock-spruce sulphite fiber is shipped to outside mills for the production of bond, manila, tissue, pure-fiber printing, and other high-grade papers requiring a strong, tough, white fiber.

Western hemlock and spruce are the standard mechanical and sulphite pulpwoods for the United States mills in the Pacific Northwest also, the hemlock being consumed in greater amounts than any other single species. In 1918, 145,583 cords of hemlock pulpwood and 35,385 cords of spruce was consumed in Washington, Oregon, and California. Of ground wood pulp the hemlock, mixed with spruce and cottonwood, amounts to 20 to 50 per cent of the total, and the yield for the mixed species is about 1,850 pounds of air-dry pulp per cord. Of pulp cooked by the sulphite process alone, the yield is about 1,050 pounds per cord. The spruce (75 per cent), mixed with black cottonwood (25 per cent), affords a yield per cord of about 950 to 1,000 pounds of bleached soda pulp suitable for the highest grades of book and writing papers made from wood. From these three woods the following papers are made: Manila, cartridge, express, bag, fiber wrappings, news, tissue, fruit wrap, toweling, sheathing, book, label, writing, and related papers.

The above facts show that the two principal species concerned are both commercially suitable for mechanical and sulphite pulps (including high-grade Mitscherlich fiber), and the papers that are usually made from them, as before specified.

While the consensus of practical opinion is that the spruce is somewhat the better pulpwood of the two, the following condensed summaries of some Forest Service semicommercial tests⁶ at the Forest Products Laboratory, at Madison, Wis., carried on for a period of 10 years, afford a good opportunity for a comparison of them. The slightly greater weight of the hemlock per unit volume of prepared wood would usually be offset in commercial practice by the greater loss in cleaning. Yields are air-dry weight per cord containing 100 cubic feet of solid wood.

⁶ See "Paper," July 30, 1919.

Sitka Spruce—

Dry weight of wood per solid cubic foot, 24 pounds.

Average fiber length, 3.5 mm.

Sulphite pulp: Yield 1,080 pounds; easily bleached; easy pulped; excellent strength and color. Possible uses, similar to white spruce; is considered the standard for sulphite pulpwood and is used for news, wrapping, book, and high-grade printings, etc.

Sulphate pulp: Yield 1,150 pounds; easily pulped; excellent strength and color. Possible uses, similar to white spruce; highest grade of kraft paper and strong fiber board.

Mechanical pulp: Yield 2,040 pounds; character, slightly grayish color. Possible uses, similar to white spruce; for practically every use where ground wood pulp is required.

Western Hemlock—

Dry weight of wood per solid cubic foot, 23 pounds.

Average fiber length, 2.7 mm.

Sulphite pulp: Yield 1,050 pounds; easily bleached; easily pulped; good strength, fair color. Possible uses, similar to white spruce; is considered the standard for sulphite pulp wood and is used for news, wrapping, book, and high-grade printings, etc.

Sulphate pulp: Yield 1,100 pounds; character, good strong fiber. Possible uses, similar to white spruce; highest grade of kraft paper and strong fiber board.

Mechanical pulp: Yield 2,160 pounds; character, good strength and fiber; grayish color. Possible uses, similar to white spruce; for practically every use where ground wood pulp is required.

The Forest Service has little test data on black cottonwood, but from the resemblance this wood bears to other "poplars," and the results of its use in mixture by some of the western mills, it may be said with a fair degree of conservatism that this species will produce, with a medium yield per cord, a ground wood pulp of good white color, of short fiber, of little strength, soft, and free from pitch. It would serve as a filler for the finer grades of ground-wood papers when properly mixed with spruce ground wood and the long-fibered sulphate pulp.

There is every reason to believe that the Alaska cottonwood as a species would serve well as a source of soda pulp for high-grade book paper. The softness of the fiber would really be advantageous, and remnants of bark, knots, and fungous stain would be of no consequence in the soda process.

LOGGING.

The use of timber for commercial pulpwood in Alaska is just beginning. The 400,000,000 feet of timber sold and cut to date from the National Forests in Alaska has been made into products such as piling, sawlogs, and shingle bolts. The logging methods have been developed from "hand logging," in which the trees were felled so

that they would fall directly into the water or could be rolled in by hand, to steam-donkey logging, the donkey being mounted on a raft and "beached" at high tide, yarding directly into the water. Later two donkeys have been used, a yarder and a roader. In the water the logs are boomed and towed to the sawmills.

The logging heretofore has been of comparatively large or selected timber. Pulpwood cuts will have a larger yield per acre than those for other purposes, as smaller timber will be cut. It is doubtful if the present system of logging is the best and cheapest that can be devised for pulpwood logging on an extensive scale. An overhead system seems to promise one solution of the problem. In this system a number of small logs could be brought to the water with a "choker." Gravity chutes might be profitably employed on the steeper slopes. To reach the material farther back, it might be necessary to put in logging railroads running along the contour. No two logging units would present the same problem; several methods of logging would likely be used on the same general operation.

In 1918, \$8.95 was the average cost for raw pulpwood at the mills in California, Oregon, and Washington. It is believed that pulpwood can be produced more cheaply in Alaska, as the greater part of the wood will be cut within less than a mile of the water's edge. Figures of \$4 to \$6 per cord would normally approximate average costs under present methods of logging.

The following cost figures are from "British Columbia, a Complete Guide," Vancouver, British Columbia, 1919:

Year.	Pulpwood. Cords.	Average value per cord.	Year.	Pulpwood. Cords.	Average value per cord.
1911.....	150	\$7.60	1914.....	80,013	\$5.33
1912.....	35,067	5.51	1915.....	90,535	6.08
1913.....	84,173	4.77	1916.....	108,997	5.32

The natural system of sheltered canals and waterways (see map, p. 40) and the proximity of most of the timber to them affords a great advantage in lessening the expense of logging. Log rafts are now towed as far as 200 miles to sawmills. Towage to the mill will be relatively inexpensive, especially if the operator uses his own tugs. It is estimated that the cost will not exceed 1 cent a mile per cord. This factor greatly reduces the original investment in logging plant, as compared, for example, with railroad operations. It also makes the physical factors in logging practically constant throughout a long period, as contrasted with the increasing cost of typical logging operations in the States, which must move farther and farther back into less accessible timber, with increasing cost of construction and operation as the rougher and higher country is penetrated.

The timber would be thoroughly soaked when delivered at the mills, but this would be of no disadvantage for ground wood pulp making except that logs left too long in salt-water storage would accumulate barnacles which it would be necessary to remove in cleaning the logs. In fresh-water storage these barnacles would doubtless drop off. It is probable that at a number of mill sites fresh-water storage would be obtainable. Soaked wood, although less desirable than fairly dry wood for sulphite pulp making, offers no great difficulty in this respect. A large number of American sulphite mills use wood coming directly from the water, and others have installed special chip driers. For making soda and sulphate pulp it is of much more importance that the wood be dry.

LABOR.

The local labor supply is adaptable to all kinds of work. Laborers are usually attracted from the woods to the canning industry, or to mining, or to the aquatic fur industry, depending on the wages paid and the conditions of employment. An assured supply of skilled labor would be available after a number of mills were established in the region, but there would, of course, always be competition from the other industries named.

It should be noted that there has been an exodus of white population from Alaska with the decline of the mining industry. It is estimated that not more than half of the 1910 population of 65,000 remains. However, the tendency to emigrate was checked in 1919, for during that year more people entered Alaska than departed from the Territory.

The Alaskan Engineering Commission, which is engaged in building a railroad from Seward to Fairbanks, imports its labor and maintains a crew of 3,000 to 4,000 men. This railroad will be completed in 1922, and competition for labor from this source will be eliminated.

It is of interest to note that laborers in Alaska are accustomed to work on a piece basis rather than on a time basis, and this would probably influence the employment of labor for logging operations. It might be desirable to consider contracting the labor for the cutting and delivery of pulpwood.

Many of the pulpwood operations in Alaska would not be located at or near towns already established. In order permanently to hold men in responsible positions under such circumstances, and to reduce the labor turnover to a minimum it would doubtless be necessary for the prospective operator to construct dwellings and to consider the extent to which he might provide such conveniences as stores and amusements to serve as inducements in securing and

retaining the full crew of laborers which is necessary for profitable operation. Social conditions would be almost entirely in the hands of the operator, and he would be guided by the trend of the times in respect to investments which are designed to secure the stability and efficiency of labor.

CONSTRUCTION OF IMPROVEMENTS.

"Construction from the ground up" summarizes the requirements to be met in Alaska, which is comparatively an undeveloped country. Following the acquisition of the timber and source of power, the mill site and town could then be advantageously located. It would be necessary to clear the site before construction could begin. A sawmill would no doubt be required, and the first logging would be for the clearing of a mill and town site, and the building of such necessary structures as wharves, storehouses, mills, dwelling houses, offices, machine shops, and stores. The power development might require the erection of a dam for storage purposes, in addition to the usual diversion works, conduits, water wheels, generators, and distributing system. Several of the structures would necessarily be of concrete. For logging, the improvements and equipment would depend on the methods employed. Scows, tugs, launches, pile drivers, and booms would be essential. During the period required for the construction and equipment of a pulp and paper mill in Alaska there would of course be no revenue.

OPERATING MATERIALS AND MILL SUPPLIES.

In addition to fuel, the more important operating supplies for pulp mills in general are lime or limestone, sulphur, soda ash, salt cake, grindstones, bleaching agents, and repair materials.

At present there are no operating limekilns in southeastern Alaska; one abandoned kiln in the Ketchikan district has been reported. A soda or a sulphate pulp mill could secure its lime by operating a kiln of its own, and there are numerous known deposits of limerock (marble) that would furnish high grades of lime (over 99 per cent CaO basis). Dolomitic limestone, however, is unknown in this region. It may be present, but no deposits have yet been located. Hence a sulphite mill requiring dolomitic lime would have to search for deposits of suitable rock or else import it from the "outside" at a high cost. By using the "tower system" of "acid" manufacture, however, a sulphite mill can employ high-calcium limestones, and British Columbia sulphite mills use this system. Such limestone is abundant among the sedimentary rocks of southeast Alaska. Belts of it miles in width are exposed on tidewater and

the rock can be quarried at small cost. The known deposits in Alaska of the high-calcium marble also could be made to serve very well for the tower system, and an enterprise could count on a cost delivered at something less than \$1.50 per ton, the prewar price. The high-calcium lime should cost delivered something less than \$5 per ton, the prewar price.

For sulphur, mills would have to depend on Japan or, more probably, on the Louisiana and Texas deposits. The cost delivered has been estimated at \$22 per ton, the prewar price.

Soda ash and salt cake, delivered from San Francisco, cost about \$27 and \$17 per ton, respectively, the prewar prices. If electrolytic bleach were made, soda ash would be obtained as a by-product.

Undoubtedly the bleaching materials, if any are required, can be supplied most cheaply by operating an electrolytic process plant. The cost of salt for this purpose, delivered from San Francisco, is about \$3 to \$3.50 per ton, the prewar price.

Grinder stones would probably be shipped from the eastern United States or from England. With respect to Fourdrinier wires, machine clothing, machinery repair parts, belting, etc., the same would be true. A much larger stock of supplies and repair materials would have to be kept on hand than in the States. Any mill in Alaska would require extensive carpenter, smith, and machine shops of its own and, very likely, a foundry; otherwise, the only adequate shops and foundries to which the mill would have access would be those at Juneau or Prince Rupert.

DISPOSAL OF MILL EFFLUENTS.

As any mill in southeastern Alaska would be built on tidewater, and as the tidal variation is about 15 to 20 feet, there would be no difficulty in satisfactorily disposing of the effluents into the sea. On this account the mills of the region would have an advantage over the great majority of mills in the United States. Although no interference is anticipated with the salmon industry, this possibility should be carefully considered.

WATER SUPPLY.

Pulp and paper mills require comparatively large quantities of pure water. The character of the water supply, like the availability of the water power, can be determined only for the individual project. The peaty discoloration and the characteristic glacial turbidity of streams that are occasionally found may be corrected by means of a filter if necessary. For the ordinary grades of newsprint it might not be necessary to filter the water.

WATER POWER.

The following extracts from an article by J. G. Hoyt, Geological Survey Bulletin 442, indicate the general water-power situation in southeastern Alaska:

Owing to topography, the streams, with the exception of a few of the larger rivers which come through the mountains from the interior, have small and precipitous drainage areas. Their courses are short and they have a large fall; in fact many of the streams are made up of a series of cataracts.

In the northern part of the area most of the streams head in the glaciers which cover a large portion of the country. In the lower southern part of the area many of the streams head in small lakes which occur a short distance back from the shore line in the hanging valleys that are characteristic of this area. Most of the streams flowing from these lakes are precipitous and many of them empty into the ocean with a cataract at the shore line. These lakes afford excellent opportunities for storage, as the topography near them is such that a dam can usually be constructed for raising their water level. The most successful powers already developed depend on such storage during a large part of the year, and further development in this region will depend on the availability of such lakes.

The run-off from the streams in this area results principally from direct rainfall, melting snow, and melting glaciers. In view of the large rainfall, the excellent forest cover, and the glacial areas, the general deduction would be that this section should have many large streams with an abundant and well-sustained run-off. This, however, is not the case, as the catchment areas are small and, although the total yield per square mile is considerable, the streams are not large and they fluctuate very rapidly.

The streams which head in lakes have a much better sustained flow and are practically the only ones in the area which are of much value for power, as any large development must depend on storage, both for the winter months and during dry parts of the summer.

The principal defect in the water supply, so far as the production of power is concerned, is the extremely low flow during the winter months. On the smaller streams, which have no storage, there is practically no flow in winter, and even on the streams having lake storage the flow is extremely low, as shown in the records for Turner River, which empties into Taku Inlet near Juneau. This stream has a drainage area of 60 square miles and heads in Turner Lake, which offers excellent facilities for storage. A portion of the area is also covered with glaciers. The scantiness of the winter flow is due largely to the meager amount of storage capacity in the ground, which freezes to bed rock, thus holding back the water.

The winter flow is particularly slight when freezing weather comes before the heavy snowfall and in those inland locations at the head of inlets or passages where the ameliorating influence of the Japan Current is less effective. It has been estimated that on several sites, no storage being provided, the ratio of low winter flow (which involves two, three, or four months) to usual summer flow is only about 2 to 5 per cent. On the other hand, it should be noted that the high-flow period in Alaska coincides with the usual low-flow period in other locations which causes so many of the pulp mills to shut down in the late summer.

In developing the timber resources it will be possible to produce cheap steam-power by the use of sawmill waste as fuel. The ultimate development, however, for both lumber and pulp will be through the establishment of mills at accessible power sites.

A great drawback to water-power development in this region is the difficulty of transmission. The country, as already stated, is cut by numerous channels, has a rough topography, and is covered with dense forests. Therefore transmission lines are difficult and expensive to construct, and this practically prohibits development at sites where the power can not be utilized at the point of development. In view of these difficulties, the possibilities at the present time for large power development in southeastern Alaska are not great, and such projects should be closely scrutinized as to their feasibility both from an engineer's standpoint and from that of an investor.

The opening of new mining districts and the development of the timber interests in this region will create a more widely distributed demand for power and enable the utilization of sites which at the present time can not be considered as available. As already stated, the success of any large water-power development, to be run during the entire year, will depend on the possibility of an adequate storage. The meager topographic data available indicate that there are probably many lakes throughout the region which will offer excellent storage facilities.

A number of power sites available for large-scale pulp and paper manufacture have been noted. In order to ascertain whether or not the powers on these sites will be fully satisfactory and how they can best be adapted, either alone or in conjunction with one another, definite surveys and other engineering investigations will be necessary, including stream-gauging through a period of years.⁷ Of the specific powers noted, the more promising are those at Fish Creek, Shrimp Bay, Mill Creek, Warm Spring Bay, Speel River, Bailey Bay, Cascade Bay, Silver Bay, Swan Lake, Thomas Bay, Tease Lake, and Sweetheart Falls. The Warm Spring Bay, Mill Creek, and Speel River powers are known to receive glacial drainage and on this account are expected to be especially susceptible to temperature changes and to have wide extremes in summer and winter flow. This is known to be true of the Speel River powers, which have been gauged continuously throughout for several years.

There is no assurance that the powers mentioned above will be the best ones obtainable in southeastern Alaska. The country is so new and unexplored that no one now knows just what specific power possibilities may eventually be located. There are numerous known streams whose power head and summer flow would probably be satisfactory, and some of them may possibly have ideal sites for storage reservoirs sufficiently large to insure a sustained winter flow of 10,000 horsepower at a comparatively small cost; but until re-

⁷ In the summer of 1915 the Forest Service established a number of stream-gauging stations in cooperation with the U. S. Geological Survey to ascertain the Alaskan power possibilities for pulp-manufacturing purposes. Twenty stream-gauging stations had been established in Alaska by 1917, and the records are being maintained. The data, including 1918, have been published as Bulletin 712-B of the Geological Survey.

cently no one has been interested in such sites, and casual knowledge of the region is not sufficient to locate them. However, the Forest Service is now conducting general reconnaissance work, and all prospective power and reservoir sites are being noted as the region is systematically cruised and mapped. In its administrative work also, efforts are continually being made to augment the existing information on power possibilities of interest to pulp and paper manufacturing enterprises.

WATER-POWER PERMITS.

The Federal water-power act (H. R. 3184) provides for the establishment of the Federal Power Commission, with offices in Washington, D. C., having authority to act in the administrative control of all power sites on the navigable waters and on the public lands and reservations of the United States, and over the location, design, construction, maintenance, and operation of power projects on such sites. Among the general duties assigned to the commission, the following are of immediate interest to those who are contemplating water-power developments: To issue preliminary permits for power projects; to issue licenses for power projects and transmission lines on navigable waters, public lands, and reservations of the United States; to prescribe rules for and to fix annual license charges; and to determine the relation of such charges to prices to consumers.

The Federal water power act applies to National Forests and provides a basis of charges as follows:

That the licensee shall pay to the United States reasonable annual charges in an amount to be fixed by the commission for the purpose of reimbursing the United States for the costs of administration of this act; for recompensing it for the use, occupancy, and enjoyment of its lands or other property; and for the expropriation to the Government of excessive profits until the respective States shall make provision for preventing excessive profits or for the expropriation thereof to themselves or until the period of amortization as herein provided is reached, and in fixing such charges the commission shall seek to avoid increasing the price to consumers of power by such charges.

The passage of this act gives stimulus to water-power development which has been handicapped in the past, largely on account of the uncertainty of tenure under the old law. The legislation provides for the issuance at reasonable rates of term licenses, which will be irrevocable except for violation of their terms.

DEVELOPED WATER POWER IN ALASKA.

About 15 water-power projects, developing a total of 37,350 horsepower, were reported in 1917 for the region of southeastern Alaska. These plants furnish power for mining and various other industries. The largest plant in southeastern Alaska develops 5,700 horsepower.

FUEL.

Fuel for steam power can be obtained from three main sources:

(1) Wood waste from logging, pulp mill, wood room, and saw-mill operations.

(2) Coal now delivered by colliers from the Vancouver Island mines and from the Alaska fields of coal and lignite when they have been developed.

(3) Fuel oil delivered in tank steamers from the California fields.

MARKETS.

The leading market for pulp and paper from the Tongass National Forest will be the United States. Its transition in 10 years from the position of an exporter of newsprint to that of an importer, securing two-thirds of its supply abroad subject to any restriction which it may be to the interest of the exporter to impose, will make it advantageous to paper users to patronize the manufacturers of Alaskan pulpwood. The successful installation of pulp and paper plants in British Columbia after a number of trials has proved that the exploitation of this general region is practicable. They represent a logical, progressive exploitation of known proportions. The conditions of acquirement of timber in British Columbia are no more advantageous than those in Alaska, nor are they likely to become so.

In 1919 the pulp and paper mills of British Columbia produced 120,000 tons of paper (mostly newsprint) and 170,000 tons of pulp (ground wood, sulphite, and sulphate).⁸ Their principal markets are the Pacific coast States of the United States, the western Provinces of Canada, Japan, Australia, and New Zealand.

The product of Alaskan mills will come into direct competition in markets now supplied by Canadian and American mills. By reason of the accessibility of timber to the Alaskan mills and favorable operating conditions, this competition should be successfully met. Manufactures in British Columbia and Alaska have little to fear from each other and much to gain in the common development of the region.

Norwegian paper was formerly shipped to Seattle and the west coast, South America, and the Orient. Because of the disadvantages they suffer as to fuel supply and raw materials European producers are likely to be supplanted in many markets by west coast mills.

The largest potential market in the Orient for the Alaskan producer is China. The annual per capita consumption there is less than one-quarter of a pound. The per capita consumption of the United States is 33 pounds per annum of newsprint alone, or 100

⁸ Pulp and Paper Magazine of Canada, Jan. 15, 1920.

pounds per capita of all papers. If the market in China were developed to one-tenth that of the United States the demand would be enormous.

The unique advantages in the exploitation of Alaskan timber are the proximity of raw materials to tidewater and natural power sites and the favorable relation to the world's markets. Obviously, a paper plant located in southeastern Alaska has a world-wide choice of markets under independent transportation conditions, either rail or water transportation being available.

TAXES.

Outside of incorporated towns no general property taxes are imposed, but all industries in Alaska, including those in incorporated towns, pay a Federal license fee which, where applicable, is based on actual yearly output. No license fees have been named to date on pulp and paper, but it is reasonable to suppose that this will be done when the industry becomes established. The fee on lumber is 10 cents per thousand feet b. m.

FREIGHT RATES.

In the absence of cargoes for shipment, it is difficult to get firm quotations as to costs of transportation. Any rate quoted would probably be above a competitive rate which could be obtained on cargo shipments. In 1914 the rates were about \$2 per marine ton (40 cubic feet) from points in the vicinity of Ketchikan to Portland and Seattle. The rate from Juneau and vicinity was about \$3 per marine ton. These rates have more than doubled for the class of merchandise included in the classification. However, there is no reason why an enterprise with the tonnage of an ordinary-sized newsprint mill should not operate its own or chartered ships so that the above rates would be approximated under conditions similar to those of the present time, especially if the return cargo were charged with its share of the expense.

In this connection it is interesting to note that the exports far exceed the imports of Alaska. The balance of trade, in favor of Alaska is about \$30,000,000 per annum. A result of this is, of course, that there is greater demand for cargo space for outbound than inbound traffic, and an explanation is afforded in a measure of the fact that coal is shipped into southeastern Alaska from Vancouver rather than from the fields along the Government railroad terminating at Seward.

In 1917 the rates on dry pulp in bales from Seattle to the Orient were about \$5.50 per 2,000-pound ton; on newsprint, \$6 to \$7. On paper of any kind the rates to Australia were \$5.50 to \$8. These

rates have been increased since 1917. In 1915 the all-water rate quoted on general cargo from coast to coast was \$8 per 2,000 pounds. In 1920 the Shipping Board quoted a rate of 90 cents per hundred from the Pacific to the Atlantic via the Panama Canal. This is \$18 per ton. It is understood that the rail rate from Seattle to New York is about \$24 per ton for newsprint. At the present prices for newsprint, this charge of one and a fraction cents per pound is not prohibitive; and, in view of the shorter time required than for water transportation, it may be favorably considered.

It is believed that shipping by rail from Prince Rupert will before long become a factor of importance. It is probable that pulp and paper shipments at very favorable rates via American-owned boats will be made in scow loads to Prince Rupert, and possibly by car ferry, to save handling and export packing. Prince Rupert also may in the future offer facilities for transshipment to coast and transocean ports. It has been estimated that shipment by scow from points in southeastern Alaska to Prince Rupert would cost 50 cents to \$1 per ton.

The following statement concerning transportation by the Grand Trunk Pacific Railway was furnished under date of July 7, 1920, by A. E. Rosevear, general freight agent of that railway, in response to an inquiry from the Forest Service:

The present freight rates of wood pulp, sulphite, or sulphate (wet or dry), in rolls or compressed in bales, carloads, from Prince Rupert, British Columbia, to Minneapolis, St. Paul, Minnesota Transfer, Duluth, and other similar eastern United States terminals, is 56½ cents per 100 pounds; to Chicago, 69 cents; and to New York, 92½ cents; minimum weight, 60,000 pounds per car. (Since the above was written a 35 per cent increase in freight rates has been made effective.)

On news-print paper, carloads, also on wrapping paper (not printed) the present rates from Prince Rupert, British Columbia, are, to Minneapolis, St. Paul, Minnesota Transfer, Duluth, and other eastern United States terminals, as well as to Chicago and New York, \$1.06½ per 100 pounds; minimum weight, 40,000 pounds per car.

The main line of the Grand Trunk Pacific Railway extends from Prince Rupert, British Columbia, to Winnipeg, Manitoba, distance, 1,748 miles. At Winnipeg it connects with the Great Northern Railway, Northern Pacific Railway, through the Midland Railway of Manitoba, also with the Canadian Pacific Railway in connection with their Sco line, as well as with the Canadian National Railways.

The grades from Prince Rupert easterly through the mountains are four-tenths of 1 per cent, with the exception of 20.15 miles of 1 per cent grade, designed for operation as a pusher grade. In effect, therefore, the Grand Trunk Pacific Railway grade against eastbound traffic is virtually four-tenths of 1 per cent as against westbound traffic an actual four-tenths of 1 per cent.

There is but one summit through the mountains of British Columbia, and this has an altitude of 3,724 feet above sea level. There are 7 short snow sheds and 11 short tunnels west of the Rockies on the way to Prince Rupert. Less

snow is experienced on the line of the Grand Trunk Pacific Railway through the mountains than on any other northern Pacific coast line, which includes the Chicago, Milwaukee & St. Paul, Great Northern, Northern Pacific, and Canadian Pacific Railways.

At Prince Rupert, British Columbia, the railway recently installed a car-ferry slip dock, and a similar slip dock has been installed at Swanson Bay, British Columbia, by the Whalen Pulp & Paper Co., in order to cater to the loading and unloading of carload traffic at Swanson Bay, thus avoiding the expense and delay occasioned by steamer service and transfer of shipments at Prince Rupert from or into cars. The distance from Prince Rupert to Swanson Bay is 112 miles.

The installation of a car-ferry slip dock at Ketchikan, Alaska, could, we understand, be easily accomplished, and navigation would be safe between that point and Prince Rupert, British Columbia, a distance of 93 miles. The channel between Prince Rupert and Ketchikan is protected practically all the way by islands, which form a natural breakwater, thus insuring safe operation of a car ferry; and the same remarks apply with equal force to other points in southeastern Alaska, such as Prince of Wales Island, Wrangell, Petersburg, Treadwell, Douglas, Juneau, Haines, and Skagway, including intermediate points.

In answer to your question as to whether a car-ferry service appeals to us as feasible under present conditions, we beg to reply in the affirmative, provided slip-dock facilities are installed and such industries located and in operation as to make it an object to the railway to inaugurate the service.

PROCEDURE IN GOVERNMENT TIMBER SALES.

National Forest timber is examined and, if its sale is desirable, it is estimated and appraised by a forest officer. It is then advertised at a minimum stumpage rate or rates, the highest bid (sealed) accompanied by the required deposit from a responsible party is accepted, and the award is made on condition of the execution of a satisfactory contract and the delivery of a sufficient bond. Required deposits are made as cutting continues, and at stated intervals the timber is reappraised and new rates fixed in accordance with the terms of the contract. The local forest officer in charge scales or measures the timber, requires the deposit of funds, and represents the Service in the enforcement of the contract.

The United States Forester is represented by the district forester and forest supervisors, who are in a position to explain in detail all the requirements as to organization, financial showing, and conditions of sale.

It should be understood that timber is sold by the Forest Service only for continuous operation, and that the general policy or form of contract does not permit the acquirement of timber on a speculative basis. The Forest Service recognizes the difficulty in promoting an enterprise of the magnitude of a pulp or paper mill in Alaska, and gladly gives assistance and data to the extent of its resources, but declines to enter into a sales contract before it is assured of the

financial ability of the applicants to operate according to the terms of the contract.

The Forest Service sells stumpage only. The purchaser of timber has no cut-over land problem, for the Government retains title to the land. Any legitimate use of the land incident to the development of the project is allowed at a nominal consideration or free of charge.

AUTHORITY TO SELL TIMBER.

The act of June 4, 1897 (30 Stat., 11), authorizes the sale of timber on the National Forests. It also permits the export of any forest product from Alaska (see any agricultural appropriation bill, and the act of February 1, 1905 (33 Stat., 628), and this permission includes, of course, the export of pulpwood and wood pulp. The act of May 14, 1898 (30 Stat., 414), prohibiting the export of timber from Alaska does not apply to National Forests. The fact that these two sections appear in the codified laws of Alaska as sections 226 and 100, respectively, without any cross reference whatever, has confused many in their search for legal authority for the exportation of timber, and on reading section 100 they have assumed such exportation was illegal.

Timber can not be legally acquired under the mining law, nor is there any provision for purchases of timberland or concessions of timber. The disposition of the timber is, as has been indicated, on a competitive bidding basis by sealed bids.

POLICY.

The policy under which the Forest Service is now working, with respect to the development of Alaskan timber resources for pulpwood, is as follows:

(1) Firm contracts are offered for sufficient timber to supply a proposed paper mill for as much as 30 years; and, if additional timber is available, which may properly be reserved from other present disposition, the Service offers as one of its contract stipulations to reserve additional stumpage from sale up to a maximum of 15 years' supply pending the completion of the first contract, and thereupon to appraise the reserved area and place it upon the market. The maximum amount of timber the Forest Service is prepared to award to one purchaser or group of interests is two billion feet board measure or its equivalent in cubic feet.

(2) The contracts provide for the reappraisal of stumpage prices at intervals of five years after timber cutting begins, the first to be made seven years after the contract is signed if the full two-year period allowed for construction is used for that purpose; but, in addition to fixing the price for the first five years, a scale of prices is named which will in no event be exceeded in the reappraisal cover-

ing the second five-year period. The possible maximum prices for the second five-year period are ordinarily double the rates fixed for the initial period. The purpose of this provision is to fix a maximum liability for the cost of timber during the first 10 years of operation of the enterprise. After the first and most critical 10 years in the life of a new enterprise of this character, reappraisals are to be without this special limitation, but must be within the average current price obtained for corresponding timber in southeastern Alaska.

(3) The reappraised rates in pulpwood contracts are based upon the current value of corresponding timber in southeastern Alaska, full recognition being given in reappraisal to the quality and accessibility of the timber included in the particular contract and to any other physical condition affecting the operations of the purchaser.

STUMPPAGE PRICES AND READJUSTMENTS.

Minimum stumpage prices for each sale are on the basis of appraisals worked out under standard methods which are applied to each unit of timber before advertisement by the Forest Service. A tract of pulpwood has recently been advertised and sale awarded on the Tongass Forest near Port Snettisham at rates of \$1 per thousand for spruce, cedar, and cypress, and 50 cents per thousand for hemlock and cottonwood.

The stumpage prices in Alaska have varied recently from 50 cents to \$3 per thousand feet, board measure, depending on the species, quality, and condition of the timber, its accessibility to tidewater, the cost of logging, etc. The appraisals are made on the basis of immediate operation, and provision is made, as hereafter explained, for reappraisal of timber under long-term contracts.

The sample contract, a copy of which is included in this bulletin, provides for a readjustment of stumpage prices after the first five years of operation following the two-year period of construction, and at five-year intervals thereafter during the life of the sale. In addition to fixing the price for the first five years, a scale of prices is named which will in no event be exceeded in the reappraisal covering the second five-year period. The readjusted rates will in no event exceed the arithmetical average price received for stumpage in the National Forest sales during the preceding 12 months from the National Forests of Alaska. The reappraisals will be based, according to contractual obligations, on the price of logs of similar species in southeastern Alaska, on the current operating costs in southeastern Alaska, and on a reasonable margin for profit and risk in the business of logging.

The general principle of the redetermination of stumpage prices during the life of long-term timber sales has been in effect on all

National Forests for many years, but the interval between reappraisal dates of saw timber sales in the States is usually three years. Pulpwood contracts in Alaska provide that these reappraisals shall be made by determining the current value of corresponding timber, due weight being given to the quality and accessibility of the stumpage and other physical factors in the particular operation. The re-appraisal plan has proved to be reasonable and fair both in principle and in application, as is evidenced by the fact that, while provision is made for an appeal to the Secretary of Agriculture from the decision of the United States Forester in fixing reappraised stumpage rates, no appeal has as yet been received. The good faith of the Forest Service has never been questioned in its reappraisal work. It is as willing and able to satisfy operators for pulpwood in Alaska as it is to satisfy operators for saw logs, pulpwood, or other materials on the National Forests in Idaho or California.

The principle of reappraisal at intervals during the life of a long-term contract for the purchase of timber from a National Forest is essential as a means of preventing speculation in Government property. Without it there would be at least an opportunity for a purchaser to have his chief interest not in a bona fide manufacturing enterprise, but rather in the chances for disposing of his contract to his own pecuniary advantage. The effect of the establishment of such a speculative system would be disastrous so far as it concerns the actual development of such industries as the manufacture of pulp and paper in Alaska. Furthermore, wholly aside from the principle that the public is entitled to a fair return for its property, the intent of the law is that National Forest timber shall be sold at not less than its market value. It is the manifest duty of the Forest Service to secure such returns from long-term as well as short-term sales.

In many respects this principle of reappraisal works to the advantage rather than to the disadvantage of the purchaser. Under Forest Service timber-sale contracts a purchaser pays for timber in relatively small amounts prior to cutting. At no time during the life of the sale is it necessary for him to make a heavy investment in standing timber. In order to justify the establishment of a new pulp and paper mill, backed by privately owned timber, a heavy initial investment in timberlands would be necessary, and this investment would be steadily increased by interest charges, taxes, and protection costs. On the Pacific coast it is customary for timberland owners to consider that their investment in standing timber doubles every 8 or 10 years. This is a fixed charge which can not be avoided. A purchaser of National Forest stumpage, however, has no such inevitable increase in the cost of his raw material, for each reappraisal merely determines the actual current value of the

stumpage. Money paid for stumpage is returned to the manufacturer in a few months, as he markets his product. The price fixed by these reappraisals may be more or may be less than the cost of similar private stumpage bought at the beginning of the sale and carried to the same time, with the increases due to interest charges, taxes, and protection. The stumpage cost of privately owned timber necessary as a backing for a pulp and paper mill would increase at a constantly accelerating rate per unit of volume because of the compounding of interest. The influence of this factor is so strong as to make the purchase of National Forest stumpage, to be paid for practically as cut and at its actual current value, preferable from a strictly business standpoint. In fact, this principle of reappraisal at intervals during the life of the contract has been accepted as reasonable and satisfactory by applicants who are now negotiating with the Forest Service for pulpwood in Alaska.

STUMPPAGE PRICE READJUSTMENTS IN CANADA.

The principle that the public is entitled to the price increment on the value of its property is recognized in the various forms of pulp licenses and sales in British Columbia, Ontario, Quebec, New Brunswick, and Nova Scotia. In each Province the timber acquired by individuals is subject to a "royalty," which is increased by "orders in council." This right to increase the royalty is equivalent to the right to readjust prices on stumpage in the Forest Service contracts, and is freely exercised in the Canadian Provinces wherever it is deemed necessary. In some Provinces the change is possible only at certain stated intervals.

FINANCIAL STANDING OF PURCHASERS.

The objects of the financial requirements are: (1) To secure as purchasers bona fide operators having adequate financial assets to carry out sale contracts successfully, and (2) to eliminate speculators and promoters who risk no capital of their own, have little permanent interest in the success of the enterprise, and seek profits primarily from the formation of a new company or the manipulation of its stock.

These requirements will not be so enforced as to prevent legitimate promotion or the financing of National Forest sales in part with borrowed capital by responsible men in accordance with conservative business standards. Evidence as to financial standing will be required before advertised timber is finally awarded and the contract furnished to the successful bidder for execution. Information as to required assets will be given in response to inquiries at the time timber is being advertised, in order that the prospective bidder may be informed as to the showing required.

AMOUNT OF CAPITAL REQUIRED.

The production of pulp and paper is always in large units, on account of the extensive investment for the developments which must be made for power, manufacture, transportation, and other facilities. Roughly, the capital required for manufacturing a given amount of stumppage into paper is thirty to forty times greater than that for manufacturing it into lumber. In 1916 the cost of a pulp and paper plant was figured by the Forest Service at \$25,000 per ton for a balanced ground-wood sulphite and paper plant producing 75 tons per day. The same plant to-day would probably cost \$4,000,000. The trade paper, Pulp and Paper Magazine, of Canada, for January 15, 1920, cited two proposed developments. One requires a capital of \$5,000,000 to build a plant covering 100 acres with an annual capacity of 75,000 tons of sulphite pulp and 35,000 tons of newsprint. Twelve thousand horsepower are required. Another plant with a 200-ton daily capacity of sulphite pulp and a ground-wood mill with a daily capacity of 200 tons of newsprint calls for an outlay of \$5,000,000 to \$6,000,000. There is likely to be great divergence in costs of plants of similar capacity in Alaska, depending on the cost of power development and the inherent conditions of the site.

The careful investigation of various sites by a competent engineer is necessary for the proper correlation of initial costs as against costs of operation. A prospective purchaser will, of course, make his own investigations of all essential features. One applicant is known to have spent more than twenty-five thousand dollars through several experts in investigations of pulp timber, water power, and general conditions before making formal applications for timber or water power.

APPLICATIONS FOR TIMBER AND WATER POWER.

There is no prescribed form of application for timber, and no priority is established by the filing of an application, for the award is based on the acceptance of the highest satisfactory bid. An application filed with the Forest Service furnishes a basis for the determination as to whether the timber is for sale and, if the application is from responsible parties, for the examination and advertisement of the timber. Definite statements as to the requirements, plans, resources, and tentative organization of the applicant are very desirable as an aid to the Service in considering applications. Applications should preferably be made to the district forester, Forest Service, Ketchikan, Alaska (Juneau, Alaska, after July 1, 1921), although they may be made through the district forester, Forest Service, Portland, Oreg., or the Forester, Forest Service, Washington, D. C. Applications for water power should be made to the Federal Power Commission, Washington, D. C.

TIME REQUIRED TO SECURE CONTRACT.

No definite statement can be made as to the length of time required to consummate a pulp-wood contract. The timber will ordinarily be advertised for at least three months. Prior to advertisement, however, the prospective purchaser must of necessity make his own expert determination of the desirability and practicability of the project. If the examiners will keep in touch with the local representatives of the Forest Service, it will usually be possible for the Service to get the timber desired in shape for advertisement and sale by the time the examinations of the company are completed and the company is ready to proceed with the development.

REFERENCES.

For the convenience of those who desire references to the literature of the industry, the following suggestions are given:

Bibliography of the Pulp and Paper Industries, by Henry E. Surface, Forest Service Bulletin No. 123. This bulletin gives a comprehensive summary of the literature up to 1913, with a list of pulp and paper trade papers, and is obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 10 cents.

The rules and regulations governing National Forests, together with the procedure in timber sales, special uses, and other activities of the Forest Service, are given in The Use Book, which may be had on application to the Forest Service.

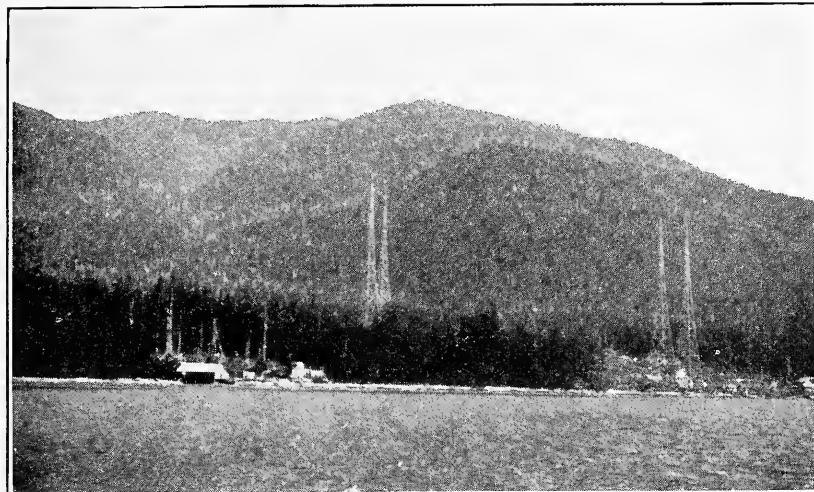
Alaskan conditions are well set forth in the annual reports of the governor of Alaska to the Secretary of the Interior. A list of references is given in these reports also to Government publications on Alaska.

Lists of manufacturers of pulp and paper mill machinery and supplies are given in Thomas's Directory of American Manufacturers.

MAPS AND SURVEYS.

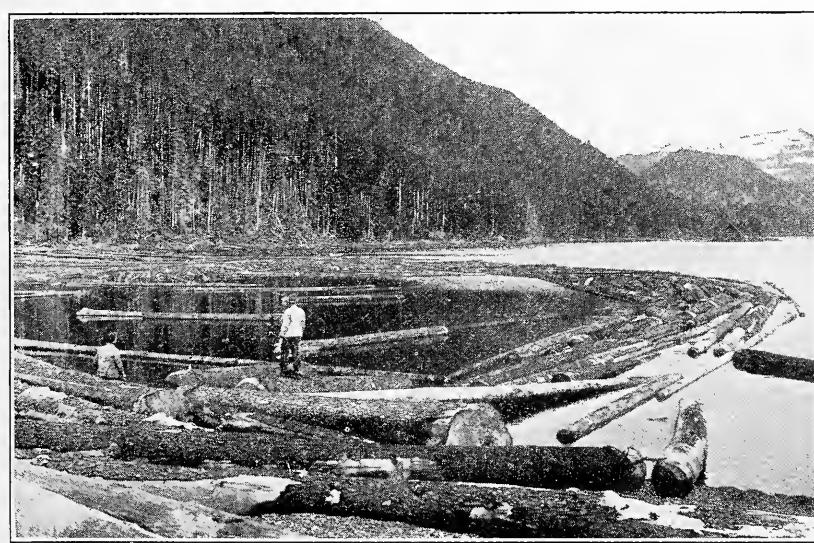
It should be understood that, although general statements of location and stand of pulpwood are given to show the sufficiency of timber for regional development, the statements are not sufficiently detailed for the segregation of pulpwood stands into operative units, properly correlated to water power and other facilities, without an independent examination and determination on the part of the prospective purchaser. When he is satisfied as to the opportunities the Forest Service will offer the timber for sale after a rough reconnaissance has been made.

The map attached shows the best present information the Forest Service has as to the location of water power and desirable pulp



F-24498A

FIG. 1.—FOREST OF HEMLOCK, SPRUCE, AND OTHER SPECIES NEAR KETCHIKAN,
ALASKA.



F-73999

FIG. 2.—LOGS CUT UNDER A FOREST SERVICE TIMBER-SALE AGREEMENT AND
HELD IN A BOOM AWAITING TOWAGE TO MILL, WHITEWATER BAY, ADMIRALTY
ISLAND.

TONGASS NATIONAL FOREST, ALASKA.



F-70500

A PAIR OF BEAUTIES—SITKA SPRUCE. THE TREE ON THE LEFT MEASURES 37 INCHES AND THE ONE ON THE RIGHT 39 INCHES IN DIAMETER.

The clearer portions of trees like these may profitably be cut into high grade-lumber. The smaller timber in the background contains much valuable pulpwood material.

units. It has been the object to allocate roughly to each water power an amount of timber properly situated to keep it in operation continuously. The Forest Service is not committed, however, to the sale of timber on the units as delineated. The map may serve as a guide for the examination of suitable locations, and no more. The Service has available on request maps of the Tongass Forest, drawn on a scale of 8 miles to the inch, which give more particulars and would be valuable in the detailed examination of pulpwood resources.

The Service has had insufficient funds to conduct intensive surveys and stream-gauging work on the Tongass Forest on a satisfactory scale, but is pushing this work as rapidly as its resources permit.

The coast line of Alaska is being charted by the United States Coast and Geodetic Survey. The charts produced are satisfactory for navigation. These maps furnish a basis for the survey of the interior, which has been partially mapped by the United States Geological Survey, the Land Office, and the Forest Service. The area indicated on the map as having been cruised does not comprise the entire area surveyed by the Service. Detached surveys are made in connection with numerous special uses, timber sales, homestead-land settlement, improvements, etc. However, the survey of an area of 20,000,000 acres with a coast line of 12,000 miles is obviously a task which it will take years to advance to a point where reasonable demands for maps and estimates of timber can be satisfied.

(Sample agreement.)

UNITED STATES DEPARTMENT OF AGRICULTURE.

FOREST SERVICE.

TIMBER-SALE AGREEMENT.

DESCRIPTION OF TIMBER.

Sales, D-6,
Tongass (pulp-
wood).

SEC. 1. We, _____, a corporation organized and existing under the laws of the State of _____, having an office and principal place of business at _____, State of _____, hereby agree to purchase an area of about _____ acres to be definitely designated on the ground by a Forest officer prior to cutting, on _____

Area and lo-
cation.

as definitely designated on the attached map which is hereby made a part of this agreement, within the Tongass National Forest, at the rate or rates, and in strict conformity with all and singular the requirements and conditions hereinafter set forth, all the dead timber standing or down and all the live timber marked or designated for cutting by a Forest officer, merchantable as hereinafter defined, for pulpwood, saw logs, and for other forest products

customarily produced in Alaska. The estimated amount to be cut under the provisions of sections 7 and 8 is

Amount. ----- cubic feet of Sitka spruce, hemlock, and other species, approximately ----- per cent Sitka spruce and ----- per cent hemlock.

Provided, That in designating the area to be cut and the areas to be reserved from sale as specified in section 2(h) herein, units, bearing timber suitable for local use may be excluded to a total amount not exceeding ----- cubic feet or equivalent amount in other units of measure if, in the judgment of the forest supervisor, the operation of the purchaser is not interfered with thereby.

Provided further, That the purchaser shall establish in Alaska, not later than -----, a pulp manufacturing plant or plants with a daily capacity of not less than ----- tons, which daily capacity shall be increased, not later than -----, to a

(Date)
total of at least ----- tons. Failure of the purchaser to make the first installation by the date first above specified shall render this agreement subject to cancellation in the discretion of the Forester; and failure to increase the daily capacity of the plant or plants by the second date above specified will render this agreement subject to such a reduction in area and volume of timber as will be, in the judgment of the Forester, commensurate with the manufacturing capacity established.

PAYMENTS.

Initial rates. SEC. 2 (a) We do hereby, in consideration of the sale of this timber to us, promise to pay to the First National Bank of Juneau, Alaska (United States depository), or such other depository or officer as shall hereafter be designated, to be placed to the credit of the United States, for the timber at the following rates:

Reappraisals. For all timber cut prior to April 1, 1928, at the following rates:

\$----- per 100 cubic feet for
Sitka spruce and Alaska cedar, and

\$----- per 100 cubic feet for
hemlock and other species.

For all timber cut on or after April 1, 1928, and prior to April 1, 1933, at such rates as shall be designated by the Forester within thirty days preceding April 1, 1928;

For all timber cut on or after April 1, 1933, and prior to April 1, 1938, at such rates as shall be designated by the Forester within thirty days preceding April 1, 1933;

For all timber cut on or after April 1, 1938, and prior to April 1, 1943, at such rates as shall be designated by the Forester within thirty days preceding April 1, 1938;

For all timber cut on or after April 1, 1943, and prior to April 1, 1948, at such rates as shall be designated by the Forester within thirty days preceding April 1, 1943;

And for all timber cut on or after April 1, 1948, at such rates as shall be designated by the Forester within thirty days preceding that date,

Except as hereinafter provided, material below merchantable size under the terms of this agreement which is cut and removed at the option of the purchaser shall be paid for at the rates then in effect for merchantable material. Material unmerchantable on account of defects may be removed without charge in the discretion of the district forester.

(b) The Forester shall reappraise and within thirty days before each of the foregoing dates designate the value of each species in consideration of current operating conditions and markets in southeastern Alaska, including the operation of the purchaser, such reappraisals to include the timber on the entire tract, and to be based upon an equitable margin for profit and risk to the purchaser under the operating conditions prevailing throughout the region: *Provided*, That the stumpage price for any species fixed upon any reappraisal date shall not exceed the arithmetical average of the prices received for National Forest stumpage of that species in southeastern Alaska during the twelve months preceding the date of reappraisal, as shown by sale contracts executed during that period; and

Provided further, That in no event shall the stumpage price for any species established by the Forester to apply during the period from April 1, 1928, to April 1, 1933, exceed double the initial rate for that species as stated above.

(c) If any material cut under this agreement and merchantable under its terms is manufactured or sold by the purchaser for other uses than pulp or its products, the Forester may upon the next reappraisal date establish a special stumpage rate for each class of material so manufactured or sold during the succeeding period, which rate, in accordance with the ratio per one hundred cubic feet currently used by the Forest Service, shall be not less than the initial stumpage price fixed herein and shall allow the purchaser an equitable margin for profit and risk under current selling prices and costs of production in the region defined above.

(d) It is further agreed that the Secretary of Agriculture will, upon written application from the purchaser showing good and sufficient reasons therefor and specifically the existence of a serious emergency arising from changes in market conditions since the last reappraisal, at his option, when action of either character is necessary to relieve the purchaser from hardship, either—

(1) Redetermine and establish the stumpage rates and designate a date when the rates as redetermined shall be effective, which date shall be within six (6) months of the date of application, or

(2) Grant an extension of time within which the respective amounts of timber specified in section 4 shall be removed, not to exceed the total period allowed for cutting all the timber.

Any stumpage rates redetermined upon application to the Secretary shall be determined in accordance with the methods and under the terms above set forth, and shall apply only during the remainder of the five-year period then current, when the rates shall be regularly designated after reappraisal.

(c) In no event, however, shall the stumpage rates for products from material whose utilization is required by this agreement as established upon any date above named, or upon application from the purchaser, be less than those specified herein to be paid for timber cut prior to April 1, 1928.

(f) It is further agreed that at the date of any reappraisal of stumpage prices the Forester may require such modifications in the sections numbered 7, 8, 13, 15, 16, 17, 18, 19, 21, 22, 23, and 24 in this agreement as are necessary, in his judgment, to protect the interests of the United States. Such modifications shall be limited to requirements contained in the then current timber sale contracts in southeastern Alaska and shall be practicable under the existing equipment and organization of the purchaser. Any additional operating costs entailed by such modifications, as ascertained by the Forester, shall be taken into consideration as a factor in reappraisals.

(g) Payments shall be made in advance installments of not less than ten thousand dollars (\$10,000) and not more than twenty thousand dollars (\$20,000) each when called for by the Forest officer in charge, except just before the completion of the sale or a period when cutting operations are to be suspended for at least three (3) months, when the amount of the payment shall be designated in writing by the Forest supervisor, credit being given for the sums, if any, heretofore deposited with the said United States depository or officer in connection with the sale.

(h) It is further agreed that an area or areas of timber located on the Tongass National Forest located _____ which areas are considered by the district forester to be accessible to the manufacturing plant of the purchaser, shall be later selected and cruised by the Forest Service. These areas shall, except in case of serious deterioration from fire, insects, or similar causes, be reserved from sale by the United States until six months prior to the completion of cutting on the area covered by this agreement, but in no event later than October 1, 1952, and it is agreed that at a date so determined the timber on the areas to be selected, together with any timber included in this agreement which in the judgment of the district forester will be uncut on March 30, 1953, shall be appraised and advertised for purchase under sealed bids, at such minimum prices and under such conditions and requirements as the Forester shall deem necessary: *Provided*, that the total amount of timber included under this agreement and on the areas to be selected shall approximate but not exceed _____ cubic feet, which amount is not guaranteed by the United States.

PERIOD OF CONTRACT.

Cutting period. SEC. 3. The cutting and removal of timber under this agreement shall begin not later than April 1, 1923, and unless extension of time is granted all timber shall be cut and removed and the requirements of this agreement satisfied on or before March 30, 1953.

Periodic cuts. SEC. 4. Unless such amounts are reduced in writing by the district forester at least _____ cubic feet

shall be cut prior to April 1, 1928; at least _____ cubic feet shall be cut prior to April 1, 1933; at least _____ cubic feet shall be cut prior to April 1, 1938; at least _____ cubic feet shall be cut prior to April 1, 1943; and at least _____ cubic feet shall be cut prior to April 1, 1948.

TITLE.

SEC. 5. The title to all timber included in this agreement shall remain in the United States until it has been paid for, and scaled, measured, or counted as herein provided. Title to timber.

SEC. 6. Timber upon valid claims and all timber to which there exists valid claim under contract with the Forest Service is exempted from this sale. Timber on claims.

DESIGNATION.

* SEC. 7. Timber shall be designated for cutting as follows: The exterior boundaries of the sale area shall be marked and all seed trees and groups of seed trees and areas considered unmerchantable or inaccessible in the judgment of the Forest officer in charge within these boundaries shall be plainly marked or posted. All other timber shall be considered as designated for cutting. Groups of trees or single trees may be reserved for seed wherever it may be deemed necessary by the Forest officer in charge: *Provided*, That not more than five per cent (5%) of the merchantable volume on the sale area shall be so reserved. All other merchantable timber shall be cut. Timber reserved in marking.

SEC. 8. The approximate minimum diameter limits outside bark at a point 4½ feet from the ground to which timber shall be designated for cutting under the terms of this agreement are fourteen (14) inches for Alaska cedar and eight (8) inches for all other species. Minimum diameter limits.

LOGGING.

SEC. 9. As far as may be deemed necessary for the protection of national forest interests, the plan of logging operations on the respective portions of the sale area shall be approved by the Forest officer in charge. When operations are begun on any natural logging area, the cutting on that area shall be fully completed to the satisfaction of the Forest officer in charge before cutting may begin on other areas, unless such cutting is authorized in writing with the requirement that cutting shall be completed on the area left unfinished as soon as practicable. After decision in writing by the Forest officer in charge that the purchaser has complied satisfactorily with the contract requirements as to specified areas, the purchaser shall not be required to do additional work on such areas. Plan of logging operations.

SEC. 10. All and only designated live trees shall be cut. No timber shall be cut until paid for, nor removed from the place or places agreed upon for sealing until scaled, measured, or counted by a Forest officer. No cutting before payment.

SEC. 11. No unnecessary damage shall be done to young growth or to trees left standing, and no trees shall be left lodged in the Damage to young growth.

process of felling. Undesignated trees which are badly damaged in logging shall be cut if required by the Forest officer in charge.

Penalty for carelessness and waste. SEC. 12. Undesignated live trees which are cut, or injured through carelessness, and designated trees left uncut on areas on which logging has been completed shall be paid for at double the current price for the class of material which they contain fixed in accordance with the terms of this agreement. Timber wasted in tops or stumps, designated timber broken by careless felling, and any timber merchantable, according to the terms of this agreement, which is cut and not removed from any portion of the cutting area when operations on such portion are completed, or before this agreement expires or is otherwise terminated, shall be paid for at the current price for such material. The amounts herein specified shall be regarded as liquidated damage and may be waived in the discretion of the Forest officer in charge in accidental or exceptional cases which involve small amounts of material. Any timber remaining on the sale area at the expiration or termination of this agreement, for which payment as specified in this section has been made to the United States, may be removed within six months from such date of expiration.

Stump height and top diameter.

SEC. 13. All cutting shall be done with a saw when practicable; stumps shall be cut so as to cause the least practicable waste and not higher than eighteen (18) inches on the side adjacent to the highest ground for all trees with a diameter of twenty-four (24) inches and under at a point 4½ feet from the ground, and not higher than twenty-four (24) inches on the side adjacent to the highest ground for all trees with a diameter over twenty-four (24) inches at the point described, except in unusual cases when in the discretion of the Forest officer in charge this height is not considered practicable; all trees shall be utilized to as low a diameter in the tops as practicable and to a minimum diameter of ten (10) inches for Alaska cedar and six (6) inches for all other species when merchantable in the judgment of the Forest officer in charge. The log lengths shall be varied so as to secure the greatest possible utilization of merchantable material.

Wood used as fuel.

SEC. 14. Wood taken from tops or unmerchantable timber for use as fuel in connection with logging operations shall be allowed free of charge.

SCALING AND MERCHANTABILITY.

Measurement.

SEC. 15. Material shall be piled, rafted, or skidded for scaling, measurement, or count if required by the Forest officer in charge and in such manner as he shall direct. Logs will be measured in cubic feet on the basis of the length and the average middle diameter inside the bark taken to the nearest inch, or, if it is impracticable to secure the average middle diameter, on the basis of the length and the average of the diameters inside bark at the two ends of the log, each measured to the nearest inch.

SEC. 16. If any pulpwood is cut in the form of cordwood instead of in logs, it shall be measured in cords of 128 cubic feet of stacked wood, and the number of cords converted into cubic feet at the ratio of one cord equaling 100 cubic feet unless or

until, as the result of actual measurements, the district forester and the purchaser shall have agreed on the use of some other ratio. Such material shall be piled for measurement as the Forest officer in charge shall direct.

SEC. 17. In obtaining the cubic contents of logs the maximum measuring length may in the discretion of the district forester be thirty-two feet; greater lengths may be measured as two or more logs.

SEC. 18. Any tree which in the judgment of the Forest officer contains one or more logs merchantable as defined in section 19, and having a net total merchantable volume of 25 per cent or more of the total volume of the tree, shall be considered merchantable under the terms of this agreement.

SEC. 19. All spruce logs are merchantable under the terms of this agreement which are not less than 16 feet long, at least 6 inches in diameter inside bark at the small end, and after deductions for visible indications of defect are estimated to contain 33 $\frac{1}{3}$ per cent sound material; all Alaska cedar logs are merchantable under the terms of this agreement which are not less than 16 feet long, at least 10 inches in diameter inside bark at the small end, and after deductions for visible indications of defect are estimated to contain 33 $\frac{1}{3}$ per cent sound material; and all logs of hemlock and other species are merchantable under the terms of this agreement which are not less than 16 feet long, at least 6 inches in diameter inside bark at the small end, and after deductions for visible indications of defect are estimated to contain 50 per cent sound material: *Provided*, That the 33 $\frac{1}{3}$ per cent aforesaid in spruce and Alaska cedar logs and the 50 per cent aforesaid in hemlock and other species shall be so located in the log as to permit the use of the sound material for pulp manufacture under the pulp manufacturing methods used in efficiently conducted pulp operations in Alaska.

SEC. 20. On request, copies or abstracts of the scale reports will be furnished to the purchaser after they have been approved by the forest supervisor.

Scaling length.

Definition of merchantable tree.

Merchantability defined.

Scale reports.

BRUSH DISPOSAL.

SEC. 21. The district forester may require that all tops shall be lopped and all brush scattered so as to lie close to the ground and away from standing trees and reproduction, or any other method of disposal the cost of which shall not be in excess of this method.

Disposal of brush.

FIRE PROTECTION.

SEC. 22. During the time that this agreement remains in force the purchaser shall independently do all in his power to prevent and suppress forest fires on the sale area and in its vicinity, and shall require his employees, contractors, and employees of contractors to do likewise. Unless prevented by circumstances over which he has no control, the purchaser shall place his employees, contractors, and employees of contractors at the disposal of any authorized Forest officer for the purpose of fighting forest fires, with the understanding that unless the fire-fighting services are

Assistance in fighting fires.

rendered on the area embraced in this agreement or on adjacent areas within one mile, payment for such services shall be made at rates to be determined by the Forest officer in charge, which rates shall be not less than the current rates of pay prevailing in the said National Forest for services of a similar character: *Provided*, That the maximum expenditure for fire fighting without remuneration in any one calendar year, at rates of pay determined as above, shall not exceed \$10,000, including the furnishing of special trains or other special service as required; and further provided that if the purchaser, his employees, contractors, or employees of contractors are directly or indirectly responsible for the origin of the fire, no payment shall be made for services so rendered, nor shall the cost of such services be included in determining said maximum expenditure for any calendar year.

It is further agreed that except in serious emergencies as determined by the Forest supervisor the purchaser shall not be required to furnish more than 100 men for fighting fire outside of the area above specified, and that any employees furnished shall be relieved from fire fighting on such outside areas as soon as it is practicable for the Forest supervisor to obtain other labor adequate for the protection of the National Forest.

SEC. 23. If required by the Forest supervisor in writing, all donkey engines or other steam-power engines shall, during the period from June 1 to October 1 of each year, burn oil, or shall be

Spark arresters. equipped with spark arresters acceptable to the Forest officer in charge, six (6) 12-quart pails, six (6) shovels, and a constant supply of not less than the equivalent of twelve (12) barrels of water, this equipment to be suitable for fire-fighting purposes, and kept in serviceable condition.

Burning of refuse. **SEC. 24.** During the period from June 1 to October 1 of each year, no refuse, brush, slash, or débris shall be burned without the written consent of the Forest officer in charge.

Transportation on logging roads. **SEC. 25.** Officers of the Forest Service, fire fighters, and other regular and temporary employees shall be transported free of charge over logging roads operated in connection with this sale not common carriers, and shall be permitted to ride upon logging trains and engines or to operate speeders when traveling upon official business. Forest officers and other employees riding on logging trains, engines, or speeders shall do so at their own risk, and the owner of the railroad expressly reserves the right to enter into an agreement with such persons before entering upon said trains or engines, or before operating a speeder, releasing the said owner from liability for any injury sustained by them in riding on said trains, engines, or speeders, arising from any cause whatsoever. In emergencies arising from forest fires, special trains shall be furnished to officers and employees of the Forest Service.

OCCUPANCY.

Logging, improvements. **SEC. 26.** The purchaser is authorized to build on National Forest land, sawmills, camps, railroads, roads, and other improvements necessary in the logging or the manufacturing of the timber included in this agreement: *Provided*, That all such structures

and improvements shall be located and operated subject to such regulation by the Forest officer in charge as may be necessary for the protection of National Forest interests. The continuance or operation of such improvements on National Forest land after this agreement has terminated shall be subject to authorization by permit or easement under United States laws, and unless such authorization is secured all improvements not removed shall become the property of the United States at the expiration of six months from the termination of this agreement.

SEC. 27. All merchantable timber used in the construction of buildings, roads, and other structures, necessary in connection with the cutting and removal of the timber covered by this agreement, shall be paid for at the current rates for such material under this agreement. Cull material and unmerchantable tops of any species may be used for such purposes without charge and shall be left in place where used.

SEC. 28. Logging camps, mills, stables, and other structures, and the ground in their vicinity, shall be kept in a clean, sanitary condition, and rubbish shall be removed and burned or buried. When camps or other establishments are moved from one location to another or abandoned, all débris shall be burned or otherwise disposed of as the Forest officer in charge shall direct.

MISCELLANEOUS.

SEC. 29. At all times when logging operations are in progress the purchaser shall have at the main camp for his employees working on the sale area a representative who shall be authorized to receive, on behalf of the purchaser, any or all notices and instructions in regard to work under this agreement given by the Forest officer in charge, and to take such action thereon as is required by the terms of this agreement.

SEC. 30. Complaints by the purchaser arising from any action taken by a Forest officer under the terms of this agreement shall not be considered unless made in writing to the Forest supervisor having jurisdiction within thirty (30) days of the alleged unsatisfactory action. The decision of the Secretary of Agriculture shall be final in the interpretation of the regulations and provisions governing the sale, cutting, and removal of the timber covered by this agreement.

SEC. 31. All operations on the sale area, including the removal of scaled timber, may be suspended by the district forester, in writing, if the conditions and requirements contained in this agreement are disregarded, and failure to comply with any one of said conditions and requirements, if persisted in, shall be sufficient cause for the termination of this agreement: *Provided*, That the district forester may, upon reconsideration of the conditions existing at the date of sale and in accordance with which the terms of this agreement were fixed, and with the consent of the purchaser, terminate this agreement, but in the event of such termination the purchaser shall be liable for any damages sustained by the United States arising from the purchaser's operations hereunder.

Construction timber.

Sanitation of camps.

Representative of purchaser.

Complaints by purchaser.

Suspension of operations.

Inspection of books. SEC. 32. All the books pertaining to the purchaser's logging operation and milling business shall be open to inspection at any time by a Forest officer authorized by the district forester to make such inspection, with the understanding that the information obtained shall be regarded as confidential.

Definition of "Forest officer." SEC. 33. The term "officer in charge" wherever used in this agreement signifies the officer of the Forest Service who shall be designated by the proper supervisor or by the district forester to supervise the timber operations in this sale.

Act of March 4, 1909.

SEC. 34. No Member or Delegate to Congress, or Resident Commissioner, after his election or appointment, and either before or after he has qualified, and during his continuance in office, shall be admitted to any share or part of this contract or agreement, or to any benefit to arise thereupon. Nothing, however, herein contained shall be construed to extend to any incorporated company, where such contract or agreement is made for the general benefit of such incorporation or company. (Section 3741, Revised Statutes, and sections 114-116, Act of March 4, 1909.)

Contract non-assignable.

SEC. 35. This agreement shall not be assigned in whole or in part.

Authority to modify agreement.

SEC. 36. The conditions of the sale are completely set forth in this agreement, and none of its terms can be varied or modified except in writing by the Forest officer approving the agreement, or his successor or superior officer, and in accordance with the regulations of the Secretary of Agriculture. No other Forest officer has been or will be given authority for this purpose.

SEC. 37. And as a further guarantee of a faithful performance of the conditions of this agreement we deliver herewith a bond in the sum of Fifty Thousand Dollars (\$50,000.00), and do further agree that all moneys paid under this agreement shall, upon failure on our part to fulfill all and singular the conditions and requirements herein set forth, or made a part hereof, be retained by the United States to be applied as far as may be to the satisfaction of our obligations assumed hereunder. We do further agree that should the sureties on the bond delivered herewith or on any bond delivered hereafter in connection with this sale become unsatisfactory to the officer approving this agreement, we will within thirty (30) days of receipt of demand furnish a new bond with sureties solvent and satisfactory to the approving officer.

Signed in duplicate this _____ day of _____, 192_____
 [CORPORATE SEAL.]

By _____

Its _____

Witnesses:

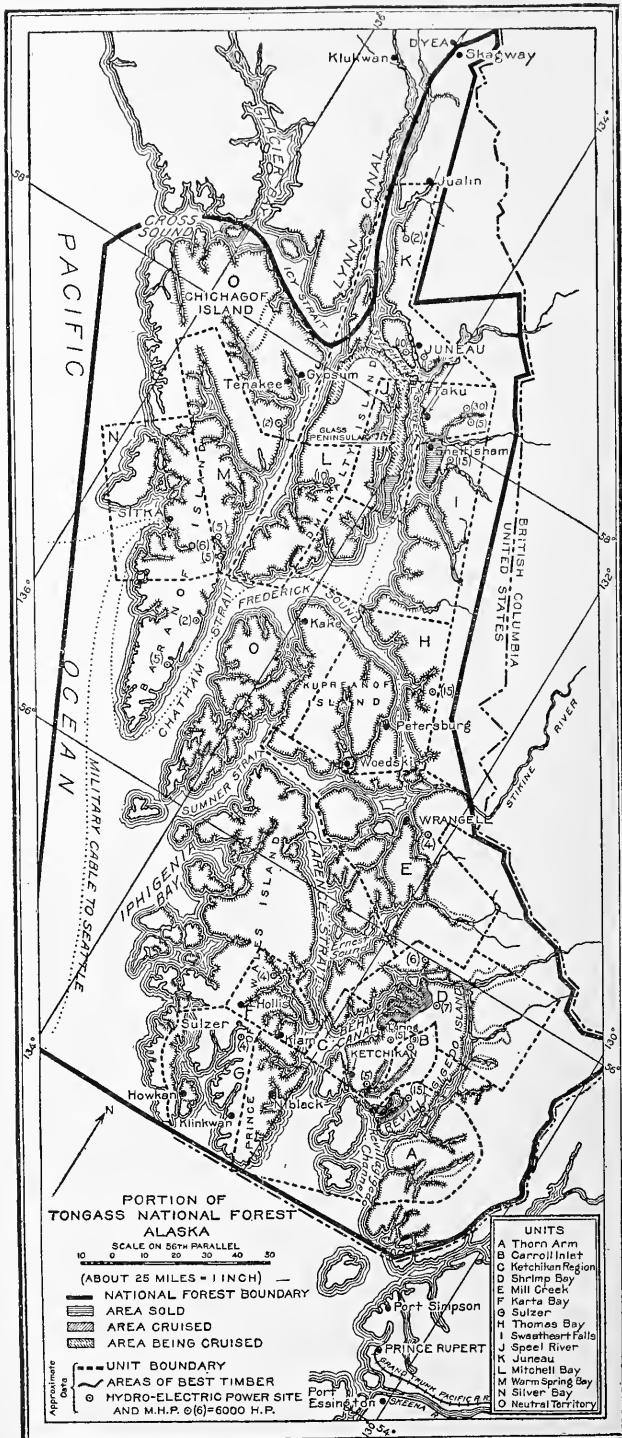
Approved at Washington, D. C., under the above conditions, _____, 192_____.

_____,
Forester.

Index to units, names of power sites, and approximate capacities.

	Unit.	Name.	Possible horse-power.
A	Thorne Arm.....	Fish Creek.....	10,000
B	Carrol Inlet.....	Swan Lake.....	9,000
C	Ketchikan Region.....	Beaver Falls.....	5,000
C	...do.....	Naha Creek.....	5,000
D	Shrimp Bay.....	Shrimp Bay.....	7,000
D	...do.....	Bailey Bay.....	6,000
E	Mill Creek.....	Mill Creek.....	4,000
F	Karta Bay.....	Karta River.....	4,000
G	Sulzer.....	Coppermount.....	4,000
H	Thomas Bay.....	Thomas Bay.....	15,000
I	Sweetheart Falls.....	Sweetheart Falls.....	15,000
J	Speel River.....	Speel River.....	20,000
J	...do.....	Long Lake.....	10,000
J	...do.....	Crater Lake.....	
J	...do.....	Tease Lake.....	5,000
K	Juneau.....	Treadwell.....	1 10,000
K	...do.....	Alaska-Gastineau.....	1 12,000
K	...do.....	Cowie Creek.....	2,000
L	Mitchell Bay.....	Mitchell Bay.....	10,000
M	Warm Springs Bay.....	Warm Springs Bay.....	5,000
M	...do.....	Cascade Bay.....	5,000
N	Silver Bay.....	Silver Bay.....	6,000
O	Neutral.....	Basket Bay.....	2,000
O	...do.....	Gut Bay.....	2,000
O	...do.....	Patterson Bay.....	5,000

¹ Developed.





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